Williamson ether synthesis is a method of preparation of ethers. It is a nucleophilic aliphatic substitution at saturated carbon in which the nucleophile is either an alkoxide ion or a phenoxide ion.

![Chemical reaction scheme]

- \( R^1 \) = alkyl, allylic, benzylic
- \( R^2 \) = alkyl, aryl

eg:

Some symmetrical ethers cannot be prepared using Williamson ether synthesis because, in addition to nucleophilic aliphatic substitution, 1,2-elimination could occur between a substrate bearing beta hydrogens and an alkoxide ion, leading to an alkene as the organic product.

eg:

\[
(CH_3)_3C-O-C(CH_3)_3
\]

1

To prepare ether 1 using Williamson ether synthesis, a *tert*-butyl substrate (2) should be reacted with the *tert*-butoxide ion (3).

\[
(CH_3)_3C-L \quad (CH_3)_3C-O^-
\]

2 3

Since alkoxide ions are strongly basic and since the substrate is a tertiary alkyl substrate, the major reaction between 2 and 3 would be 1,2-elimination, giving alkene 4 as the organic product.

\[
(CH_3)_3C-L \quad (CH_3)_3C-O^-
\]

2 3

4

Preparation of unsymmetrical ethers using Williamson ether synthesis requires planning because, again, in addition to nucleophilic aliphatic substitution, 1,2-elimination could occur between some substrates and alkoxide ion and could be the dominant process.

eg:
Contributors

- Gamini Gunawardena from the OChemPal site (Utah Valley University)